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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/071,846	02/08/2002	David J. Beebe	032026:0554	1391
23524	7590	04/09/2004	EXAMINER	
FOLEY & LARDNER 150 EAST GILMAN STREET P.O. BOX 1497 MADISON, WI 53701-1497			SINES, BRIAN J	
			ART UNIT	PAPER NUMBER
			1743	

DATE MAILED: 04/09/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/071,846	Applicant(s) BEEBE ET AL.	
	Examiner Brian J. Sines	Art Unit 1743	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 1/12/2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-51 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 36-40 and 44-47 is/are allowed.
- 6) ☒ Claim(s) 1-14, 19-35, 41-43 and 48-51 is/are rejected.
- 7) ☒ Claim(s) 15-18 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

The restriction election requirement mailed 12/08/2003 has been withdrawn.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

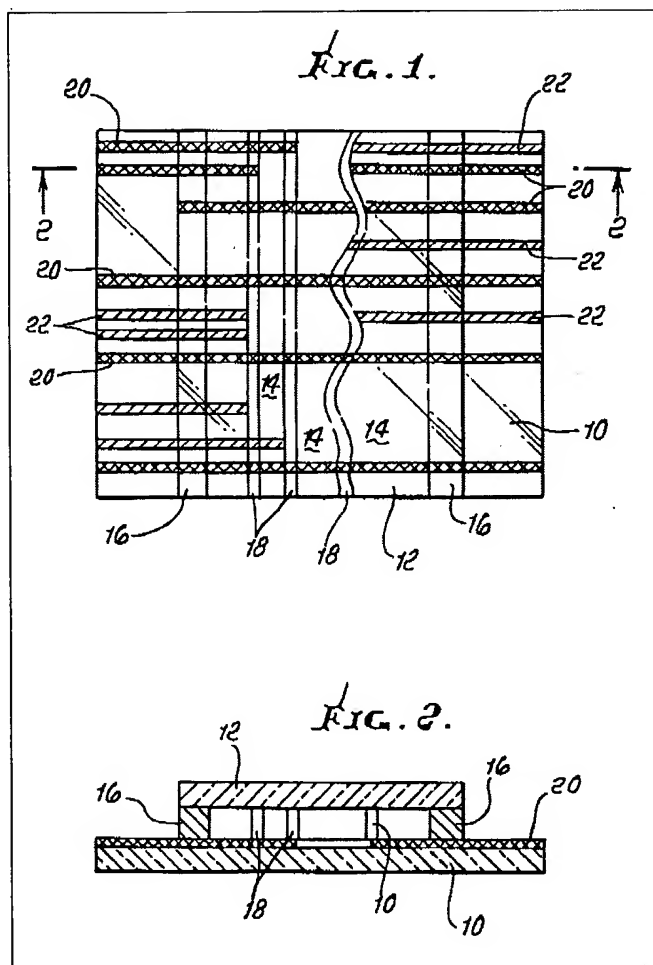
A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1 – 5, 8 – 12, 14, 21 – 25, 28 – 32, 41 – 43 and 48 – 51 are rejected under 35 U.S.C. 102(b) as being anticipated by Oh (U.S. Pat. No. 5,904,824 A). Oh anticipates an apparatus comprising: a base having a surface; a cover having a surface facing the base surface and spaced from the base surface by 1,000 μm or less; a flow guiding stripe region comprising hydrophilic (wetable) and hydrophobic (nonwetable) areas; and adjacent facing regions on the base surface and cover surface defining a flow path. Oh teaches a method and associated apparatus for confining an aqueous solution on a flat glass surface by forming two siliceous sheets (i.e., sheets made of either quartz, soda or lead glasses) each of which have facing sides containing hydrophilic and hydrophobic areas, and opposing the facing sides of each of the sheets to form therebetween a fluid capillary which is hydrophilic and bounded by hydrophobic areas adapted to provide at least one hydrophilic pathway (see col. 2, lines 41 – 64; col. 3, line 6 – col. 7, line 65; figures 1 & 2). Oh further teaches the incorporation of electrodes for facilitating sample fluid movement or for pumping sample liquid onto the flow guiding stripe

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region (see col. 5, lines 36 – 51). Oh anticipates the use of photolithographic patterning in fabricating the claimed apparatus (see col. 4, lines 12 – 66).



Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 13 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh in view of Weigl et al. (U.S. Pat. No. 6,159,739 A). Oh does not specifically teach the incorporation of a syringe pump with the disclosed apparatus. However, Weigl et al. do teach the use of syringe pumps for introducing fluids into microfluidic devices (see col. 8, lines 17 – 21). Hence, as evidenced by Weigl et al., the use and incorporation of syringe pumps with microfluidic devices to facilitate effective sample fluid introduction are notoriously well known in the art (see MPEP § 2144, 2144.02 & 2144.03). Consequently, a person of ordinary skill in the art would accordingly have had a reasonable expectation of success in incorporating the use of a syringe pump, as suggested by Weigl et al., with the microfluidic apparatus of Oh. The Courts

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have held that the prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success. See *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986) (see MPEP § 2143.02). Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate a syringe pump, as taught by Weigl et al., with the microfluidic apparatus of Oh, in order to facilitate effective sample fluid flow control.

Claims 6, 7, 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh in view of Burns et al. (WO 98/22625). Oh does not specifically teach the use of a trichlorosilane as a hydrophobic coating. However, Burns et al. do teach the incorporation of a trichlorosilane, such as n-octadecyltrichlorosilane, as a hydrophobic coating reagent in a microfluidic apparatus (see p. 10). The Courts have held that the selection of a known material, based upon its suitability for the intended use, is within the ambit of one of ordinary skill in the art. See *In re Leshin*, 125 USPQ 416 (CCPA 1960). Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of a trichlorosilane reagent, such as n-octadecyltrichlorosilane, as a hydrophobic coating, as taught by Beebe et al., within the microfluidic apparatus of Oh in order to provide for an effective and proven hydrophobic coating.

Claims 19, 20, 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh in view of Beebe et al. ("Functional Hydrogel Structures for Autonomous Flow Control Inside Microfluidic Channels," *Nature*, Vol. 404, 4/6/2000, pp. 588 – 590). Oh does not specifically teach the incorporation of a functional hydrogel barrier positioned between flow guiding stripes to facilitate controlled sample fluid flow within the apparatus. However, Beebe et

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al. do teach functional hydrogel structures for autonomous flow control within microfluidic channels. Beebe et al. also teach various advantages imparted by the use of their technology in conventional microfluidic systems (see pp. 588). As a result, a person of ordinary skill in the art would accordingly have had a reasonable expectation of success in incorporating the use of the functional hydrogel components taught by Beebe et al. with the microfluidic apparatus of Oh. The Courts have held that the prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success. See *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986) (see MPEP § 2143.02). Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate these functional hydrogel structures, as taught by Beebe et al., with the apparatus of Oh, in order to facilitate effective sample fluid flow control.

Allowable Subject Matter

Claims 36 – 40 and 44 – 47 are allowed.

Claims 15 – 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

The cited prior art neither teach or fairly suggest the further incorporation within the apparatus of Oh at least one side channel having a bottom wall and two side walls, the cover extending over the at least one side channel and having a surface spaced from and facing the bottom wall of the side channel, the at least one side channel intersecting the main channel, a flow guiding stripe formed on the bottom wall of the side channel and an adjacent facing flow

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guiding stripe formed on the cover surface that are wettable by the selected liquid, and a region on the bottom wall of the side channel and on the facing cover surface adjacent to the flow guiding stripes in the side channel being nonwettable by the selected liquid, the flow guiding stripes in the side channel intersecting and joining the flow guiding stripes in the main channel.

The cited prior art neither teach or fairly suggest a method of forming a microfluidic flow guiding structure, the method comprising the steps of: forming a channel in a base and a cover, the channel having a bottom wall and two vertical sidewalls in the base and a surface of the cover spaced from and facing the bottom wall, the height of the channel between the bottom wall and the facing cover surface being 1,000 μm or less; injecting into the channel at least two parallel streams of liquid and flowing them together in the channel in adjacent laminar flow in contact with the bottom wall and the cover surface, one of the liquids being a solvent which does not affect the surface of the bottom wall of the channel and the cover surface and the other of the liquids being material that deposits a self-assembled monolayer onto the surface of the bottom wall of the channel and the cover surface over which the stream of liquid passes, the material of the bottom wall of the channel and of the cover surface being wettable by a selected liquid and the self-assembled monolayer deposited on the surfaces being nonwettable by the selected liquid.

The cited prior art neither teach or fairly suggest a method of guiding microfluidic flows of liquid, the method comprising the steps of: providing a micromachined flow guiding structure having a base having a surface and a cover with a surface facing the base surface, the cover surface spaced from the base surface, adjacent facing regions on the base surface and cover surface defining a flow path from a source position to a destination position on the base and cover surfaces, a region on at least one of the base and cover surfaces formed as a flow guiding

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stripe wettable by and having a wetting angle of less than 90° with respect to a first liquid, and a region adjacent to the guiding stripe being nonwettable and having a wetting angle of greater than 90° with respect to the selected liquid; injecting the selected liquid onto the flow guiding stripe; and injecting a second liquid onto the regions adjacent to the guiding stripes and in contact with the first liquid, the second liquid being immiscible with the first liquid and nonwettable with respect to the guiding stripes.

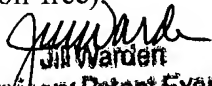
Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Quake et al. teach a microfabricated analytical apparatus. O'Connor et al. teach fluidic impedances in microfluidic systems.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian J. Sines, Ph.D. whose telephone number is (571) 272-1263. The examiner can normally be reached on Monday - Friday (11:30 AM - 8 PM EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill A. Warden can be reached on (571) 272-1267. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


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Technology Center 1700